

**CLAIMS:**

1. A processing system for removing contaminant particles from substrates, comprising:

at least one processing enclosure having a particle removal assembly positioned therein, the particle removal assembly comprising:

a substrate support member;

a broadband actuator in communication with the substrate support member; and

an air knife assembly positioned proximate the substrate support member, the air knife assembly being configured to generate a high pressure laminar flow of gas across the surface of the substrate;

a substrate transfer enclosure in communication with each of the at least one processing enclosures;

at least one substrate supply source in communication with the substrate transfer chamber; and

at least one transfer robot positioned in the substrate transfer enclosure, the transfer robot being configured to transfer substrates between the at least one substrate supply source and the at least one processing enclosure.

2. The processing system of claim 1, further comprising at least one inspection station in communication with the substrate transfer enclosure.

3. The processing system of claim 2, wherein the at least one inspection station is positioned within the substrate transfer enclosure.

4. The processing system of claim 1, further comprising a wafer aligner positioned in communication with the substrate transfer chamber.

5. The processing system of claim 1, wherein the substrate transfer enclosure comprises a factory interface

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6. The processing system of claim 1, wherein the at least one processing enclosure is positioned within the substrate transfer enclosure.

7. The processing system of claim 1, wherein the substrate support member comprises an upper substrate receiving surface, an intermediate reinforcement member affixed to a lower portion of the substrate receiving surface, and a longitudinal stem portion affixed to a lower end of the reinforcement member.

8. The processing system of claim 7, wherein the broadband actuator is positioned in an interior portion of the longitudinal stem portion of the substrate support member.

9. A processing system for cleaning contaminant particles from a substrate surface, comprising:

a factory interface enclosure;

at least one substrate pod loader attached to the factory interface enclosure;

at least one substrate transfer robot positioned in the factory interface enclosure; and

at least one substrate cleaning assembly positioned to receive substrates from the at least one substrate transfer robot, wherein the at least one substrate cleaning assembly comprises:

a substrate support member;

a broadband actuation device in communication with the substrate support member; and

→ a particle removal device configured to sweep away dislodged particles from an area proximate the substrate surface.

10. The processing system of claim 9, wherein the substrate support member comprises:

a disk shaped substrate receiving member;

a reinforcement member affixed to an under side of the substrate receiving member; and

a support stem affixed to the reinforcement member.

12. The processing system of claim 10, wherein the disk shaped receiving member includes a plurality of reinforcement members formed into the underside, the plurality of reinforcement members being configured to prevent deflection of the substrate receiving member.

13. The processing system of claim 10, wherein the broadband actuation device is in communication with the support stem.

14. The processing system of claim 10, wherein the broadband actuation device is positioned within a hollow interior cavity formed into the support stem.

15. The processing system of claim 9, wherein the broadband actuation device comprises a piston assembly configured to impact a terminating end of a cylinder, wherein the impact of the piston assembly with the terminating end generates a broadband impulse.

16. The processing system of claim 9, further comprising an inspection station in communication with the factory interface enclosure.

17. The processing system of claim 16, wherein the inspection station is configured to detect the presence or absence of contaminant particles on the surface of the substrate.

18. The processing system of claim 16, further comprising a system controller in communication with at least one of the metrology station, the broadband actuation device, the particle removal device, and the at least one transfer robot, the controller being configured to provide operational control signals thereto.

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